REMARKS

A Petition (and fee) for a One-Month Extension of Time is attached hereto.

An Excess Claim Fee Payment Letter and fee are attached herewith.

Claims 1-4, 6-8, and 11-41 are all of the claims presently pending in the application. Claims 5, 9, and 10 have been canceled above. New claims 32-41 have been added to more completely define the invention.

Claims 18-19, 21-23, and 25 stand rejected upon informalities (e.g., 35 U.S.C. § 112, second paragraph), and claims 1-6 and 12-25 stand rejected on prior art grounds.

With respect to the prior art rejections, claims 1-3, 5-6, 16, 18, 23, and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sugaya (U.S. Patent No. 5,812,710). Claims 4, 12, and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sugaya in view of Luo, et al. (U.S. Patent No. 6,008,932). Claims 13-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sugaya in view of Terahara (U.S. Patent No. 6,097,535). Claim 17 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sugaya in view of Tsuda, et al. (U.S. Patent No. 6,038,063). Claims 18-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sugaya in view of Kinoshita (U.S. Patent No. 6,342,965). Claims 20 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Glance (U.S. Patent No. 5,764,821) in view of Sugaya. Claims 1, 7-11, 21-22, and 26-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kosaka (U.S. Patent No. 6,094,296).

These rejections are respectfully traversed in view of the following discussion.

Attached hereto is a marked-up version of the changes made to the claims by the present Amendment. The attached page(s) is captioned "**Version with Marking to Show Changes Made**".

It is noted that the claim amendments herein are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims, or for any statutory requirements of patentability.

Further, it is noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by independent claim 1, is directed to a an optical switch for transmitting or shutting down an input light signal in accordance with a set switching state.

The inventive switch of claim 1 includes a first optical amplifier which includes a first erbium-doped fiber (EDF), and a first optical pumping source connected to the first EDF with a first optical branch. A second optical amplifier is connected in cascade to the first optical amplifier, and includes a second EDF, and a second optical pumping source connected to the second EDF with a second optical branch. A first optical coupler is connected to the first optical amplifier, and a second optical coupler is inserted between the first and second optical amplifiers, and a first control circuit outputs first and second control signals for switching a gain of the first and second optical amplifiers.

Thus, the inventive optical switch includes first and second optical amplifiers connected in cascade. In a non-limiting exemplary embodiment, when EDFs (11 and 12; it is noted that all reference numerals used herein are for the Examiner's clarity and understanding only, and not for limiting the claims in any way) and pumping sources (31 and 32) are used as the first and second optical amplifiers, the switching is accomplished by switching on or off the pumping sources (31 and 32) in accordance with control signals supplied from a control circuit (300). One input light signal can be dropped through a first optical branch (51) located

on the input side of the optical switch, while another input light signal can be added through a second optical branch (53).

Thus, an important feature of the inventive arrangement is a first control circuit for outputting first and second control signals for switching a gain of the first and second optical amplifiers. Further, the route of light can be switched using the switching function of the first optical amplifier.

With the invention, it is possible for a single gate switch to obtain a high gain and a high power without having an adverse influence on transmission properties.

Independent claims 20 and 21 recite similar limitations.

Such features are not taught or suggested by any of the prior art of record, either alone or in combination.

II. THE 35 U.S.C. §112, SECOND PARAGRAPH REJECTION

Regarding the §112, second paragraph, rejection, claims 7-11, 21-22, and 28-30 have been amended in a manner believed fully responsive to all points raised by the Examiner.

In view of the foregoing, reconsideration and withdrawal of this rejection is respectfully requested.

III. THE PRIOR ART REJECTIONS

A. The §103(a) Rejection based on Sugaya et al.

Sugaya fails to render obvious the claimed invention.

First, there would have been no reason or motivation found in Sugaya to modify Sugaya in the manner urged by the Examiner. Indeed, Sugaya's invention is directed to "gain equalization." Therefore, it fails to have the object, purpose, function or structure for shutting down the amplifiers, as in the claimed invention, which allows the switching of the gain of the first and second amplifiers.

Further, Sugaya discloses an apparatus for optical equalization and amplification. The Examiner refers to Figure 23 and alleges that Sugaya discloses a first optical amplifier 122, a second optical amplifier 123 and a first control circuit 127 for outputting first and second control signals for switching a gain of the first and second amplifiers. Applicant respectfully submits that this is incorrect.

That is, the purpose of the Sugaya's invention is to keep constant an output level of optical fiber amplifying unit. To achieve this object, Sugaya uses a variable optical attenuation unit which is controlled by a feedback signal. Indeed, referring to column 18, lines 37-42, Sugaya discloses that "[t]he CPU controlled circuit 127, which includes CPU, control the light intensity of the excitation light generated by the light sources 124, 125, and 126 based on the optical level of each channel detected by the photodiodes 113-1-113-n." Thus, this passage makes clear that Sugaya is performing only an attenuating function, not switching the gain of first and second amplifiers, as in the claimed invention.

Thus, Applicant submits that it is clear that the Examiner is engaging in impermissible hindsight reconstruction of the invention, only after a thorough reading of Applicant's own specification. This, as the Examiner well-knows, is prohibited.

Additionally, even assuming arguendo that one of ordinary skill in the art would have been motivated to modify Sugaya, the claimed invention would still not have been produced. That is, there is no teaching or suggestion of the "switching of a gain" as in the claimed invention.

Additionally, there is no teaching or suggestion of the structure of the first and second couplers of the invention defined by independent claims 1 and 20. Additionally, there is no teaching or suggestion of the function of the second coupler, as defined by new claims 32 and 33.

Thus, turning to the clear language of claim 1, there is no teaching or suggestion by Sugaya of "*a first optical amplifier which includes:*

a first erbium-doped fiber; and

a first optical pumping source connected to said first erbium-doped fiber with a first optical branch;

a second optical amplifier connected in cascade to said first optical amplifier, and which includes:

a second erbium-doped fiber; and

a second optical pumping source connected to said second erbium-doped fiber with a second optical branch;

a first optical coupler connected to said first optical amplifier;

a second optical coupler inserted between said first and second optical amplifiers; and

a first control circuit for outputting first and second control signals for switching a gain of said first and second optical amplifiers (emphasis Applicant's).

Thus, independent claim 1 (as well as independent claims 20 and 21 which recite this and other features) is not taught or suggested by Sugaya.

Regarding dependent claim 23, as mentioned in the previous Amendment, Sugaya's optical coupler located between optical amplifiers has a different structure and purpose from the present invention. Thus, there would have been no reason or motivation to modify Sugaya, absent impermissible hindsight.

The Examiner again asserts that Sugaya discloses "shutting down of the first and second amplifiers" (col. 18, lines 37-42). However, looking closer at column 18, lines 37-42 of Sugaya, such a passage does not disclose or suggest any "shutting down" of the first and second amplifiers.

Such a passage merely discloses that the CPU controlled circuit 127, which includes a CPU, controls the light intensity of the excitation light generated by the light sources 124,

125, and 126 based on the optical level of each channel detected by the photodiodes 113-1-113-n." Thus, this passage is irrelevant to "shutting down" the first and second amplifiers and clearly fails to teach or suggest such a feature, as defined by claim 23.

In sum, Sugaya's invention is directed to "gain equalization." Therefore, it fails to have the object, purpose, function or structure for shutting down the amplifiers (or switching a gain thereof), as in independent claim 1 (or independent claims 20 and 21).

Hence, the present invention is clearly patentable over Sugaya.

Further, regarding the §103 rejections discussed in turn below, none of the secondary references teaches or suggests the claimed invention and fails to make up for the above-mentioned deficiencies of Sugaya. Indeed, the other references are cumulative to Sugaya and have the same purpose as Sugaya, as discussed below.

B. The §103 Rejection Based on Sugaya et al. in view of Luo et al.

Regarding this rejection of claims 4, 12, and 15, first Applicant submits that one of ordinary skill in the art would not have been motivated to make the Examiner's urged combination. That is, Sugaya and Luo are each directed to very different problems (different from that of the present invention) and attempt to solve them in very disparate way.

Indeed, Sugaya is directed to providing an amplifier for keeping a constant optical output level and equalizing output levels of a plurality of wavelengths elements (e.g., see column 2, lines 36-40 of Sugaya).

In contrast, Luo is directed to preventing degradation in a system's bit error rate due to gain transients resulting from the deletion or addition of one or more channels due to, for example, channel failure or bursty traffic. None of these specific problems or solutions is affirmatively encountered (or addressed) by the present invention.

Thus, given the different problems and very different solutions of Sugaya and Luo, there would have been no motivation or reason to combine the references, absent impermissible hindsight.

Morever, even assuming arguendo that the references would have been combined, Luo fails to make up for the deficiencies of Sugaya discussed above.

That is, Sugaya does not teach or suggest a switching of the gain. Moreover, Sugaya does not teach or suggest switching the route of light by using a switching function of the first optical amplifier. Additionally, there is no teaching or suggestion of the structure or the function of the first and second couplers of the invention defined by independent claims 1 and 20. Luo adds nothing to Sugaya, and indeed is merely cumulative to Sugaya.

Thus, claims 4, 12, and 15 are patentable over the Examiner's urged combination of Sugaya and Luo.

C. The §103 Rejections based on Sugaya et al. in view of Terahara or Tsuda, or Kinoshita

Regarding claims 13-14, 17, and 19, the Examiner secondarily relies on Terahara, Tsuda or Kinoshita, respectively. However, these references are clearly deficient in making up for the shortcomings of Sugaya discussed above.

Again, the purpose of Sugaya's invention is to keep constant an output level of optical fiber amplifying unit, which uses a variable optical attenuation unit which is controlled by a feedback signal.

However, the invention uses a gain switching function of a first control circuit for outputting first and second control signals for switching a gain of the first and second optical amplifiers. Hence, the invention can switch the route of light signals by using a switching function of the first optical amplifier.

Terahara, Tsuda, and Kinoshita have the same purpose as Sugaya and disclose nothing

about switching of the gain of first and second optical amplifiers. Additionally, there is no teaching or suggestion of the structure or the function of the first and second couplers of the invention defined by independent claims 1 and 20.

Thus, claims 13-14, and 17-19 are patentable over Sugaya in view of any of Terahara, Tsuda or Kinoshita, respectively.

D. The §103 Rejection based on Glance in view of Sugaya et al.

Regarding claims 20 and 24, Glance discloses a large capacity local access network. As admitted by the Examiner, Glance does not disclose, teach or suggest an optical switch comprising first and second optical amplifiers and a control circuit.

Sugaya is cited for such a teaching. However, even assuming arguendo that Sugaya would have been combined with Glance, as discussed above, Sugaya fails to teach or suggest the limitations discussed above and as recited in claims 20 and 24.

As mentioned above, Sugaya's invention is directed to "gain equalization." Therefore, it fails to have the object, purpose, function or structure for shutting down the amplifiers, as in the claimed invention, which allows the switching of the gain of the first and second amplifiers.

Again, the first control circuit 127 fails to output first and second control signals for switching a gain of the first and second amplifiers. Gain equalization in Sugaya is far different from a function of "gain switching" as in the claimed invention.

That is, the purpose of Sugaya's invention is to keep constant an output level of optical fiber amplifying unit. To achieve this object, Sugaya uses a variable optical attenuation unit which is controlled by a feedback signal. As discussed above in reference to column 18, lines 37-42, Sugaya is performing only an attenuating function, not a switching of the gain of first and second amplifiers, as in the claimed invention.

Hence, even if Sugaya discloses an optical switch comprising first and second optical

amplifiers and a control circuit, there is no teaching or suggestion of the control circuit switching a gain of the first and second optical amplifiers. Additionally, there is no teaching or suggestion of the structure or the function of the first and second couplers of the invention defined by independent claims 1 and 20.

Thus, independent claims 20 and 24 which recite the above and other features is not taught or suggested by Glance in view of Sugaya.

E. The §103 Rejection based on Kosaka et al.

Regarding claims 1, 7-11, 21-22, and 26-31, Kosaka discloses an optical amplification apparatus.

The Examiner refers to column 6, lines 11-27 of Kosaka and asserts that Kosaka teaches a control circuit (e.g., 14 in Figure 4) which is allegedly for outputting first and second control signals for switching a gain of the first and second optical amplifiers.

However, control circuit 14 is for adjusting the deviation of optical power between wavelengths. Indeed, column 6, lines 12-17 of Kosaka disclose that:

> *...if the gain of the optical amplifier unit 9 is determined by setting an excitation light amount of the excitation light source 11 such that the optical output power of light at wavelength is +10 dBm, and excitation light amounts of the excitation light sources 22b, 22c in the optical gain adjusters 17b, 17c are adjusted to determine the gain of light at wavelengths λ_2, λ_3 in accordance with the setting of the optical amplifier unit 9, the output power of the light at the respective wavelengths and the deviation of optical power between the wavelengths can be arbitrarily adjusted. The control for adjusting the excitation light amounts outputted by the excitation light sources 11, 22b, 22c, is performed by the control unit 14.*

This operation by the control unit 14 is irrelevant to switching a gain of the amplifiers,

as performed by the control circuit of the claimed invention. Indeed, Kosaka clearly fails to disclose, teach or suggest an optical switch comprising a first control circuit for outputting first and second control signals for switching a gain of the first and second optical amplifiers.

Along these lines, Kosaka is somewhat similar to Sugaya's invention directed to "gain equalization." Therefore, one of ordinary skill in the art would not have been motivated to modify Kosaka as urged.

More specifically, Kosaka fails to have the object, purpose, function or structure for shutting down the amplifiers, as in the claimed invention, which allows the switching of the gain of the first and second amplifiers. Indeed, the control circuit 14 fails to output first and second control signals for switching a gain of the first and second amplifiers. The control for adjusting the excitation light amounts outputted by the excitation light sources 11, 22b, 22c, in Kosaka is far different from a function of "gain switching" as in the claimed invention. As discussed above, Kosaka is merely performing an attenuating function, not a switching of the gain of first and second amplifiers, as in the claimed invention.

Additionally, even if an ordinarily skilled artisan would have been motivated to modify Kosaka in the manner urged, the claimed invention would still not have resulted.

That is, there would still not be disclosed or suggested an optical switch including "*a first optical amplifier which includes a first erbium-doped fiber; and a first optical pumping source connected to said first erbium-doped fiber with a first optical branch;*

a second optical amplifier connected in cascade to said first optical amplifier, and which includes: a second erbium-doped fiber; and a second optical pumping source connected to said second erbium-doped fiber with a second optical branch;

a first optical coupler connected to said first optical amplifier;

a second optical coupler inserted between said first and second optical amplifiers; and

a first control circuit for outputting first and second control signals for switching a

gain of said first and second optical amplifiers", as in independent claim 1.

Indeed, there is nothing within Kosaka which teaches or suggests the structure (or the function) of the fist and second couplers, or that of the control circuit of the present invention, as defined by independent claims 1 and 20. As clearly defined in new dependent claims 31-32, the second coupler is for receiving input light to increase a power of the input signal, whereas the control circuit is for switching the gain of the first and second amplifiers, as discussed above.

Presumably, as described on page 10 of the Office Action, the Examiner is relying on the multiplexer 19 in Figure 4 of Kosaka for teaching a second coupler as in the claimed invention. However, the multiplexer clearly has a different structure and function from that of the second coupler of the invention. Indeed, there is a clear functional difference between the second coupler (e.g., as shown by reference numeral 53 in Figure 6 in an exemplary embodiment of the present invention) and the multiplexer 19 of Kosaka.

That is, the second coupler of the invention can add another input optical signal (from the transmission line 106 as exemplarily shown in the nonlimtiing embodiments of Figure 6) and reinforce the input optical power.

In complete and fundamental contrast, the multiplexer 19 merely multiplexes the plurality of optical signals having each wavelength. Such a difference would be clearly recognizable by one of ordinary skill in the art, after reading the present application.

Indeed, it is submitted that the Examiner clearly recognizes the difference in structure and function of the second coupler and a multiplexer, by the fact that independent claim 21 recites "a plurality of second optical couplers" as well as "at least one first optical wavelength multiplexer". The Examiner attempts to apply different components from Kosaka against these limitations. Accordingly, this is evidence that the function of the second coupler and the multiplexer are indeed different. Otherwise, there would be no need for reciting the multiplexer.

Additionally, as noted above and as described in the present application, the present invention can switch on or off according to the second coupler. There is no teaching or suggestion of this feature by Kosaka.

Thus, independent claims 1, 21 and 22 which recite the above and other features are not taught or suggested by Kosaka.

Additionally, dependent claims 7, 11, 22, and 26-31 are patentable over Kosaka not only by virtue of their dependency on the above mentioned independent claims, but also for the additional limitations which they recite.

For the reasons stated above, the claimed invention is fully patentable over the cited references.

III. Formal matters and Conclusion

To overcome the Examiner's objection to claim 23, claim 23 has been amended.

In view of the foregoing, Applicant submits that claims 1-41, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to the Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 4/7/03

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VERSION WITH MARKING TO SHOW CHANGES MADE

Please cancel claims 5, 9, and 10 without prejudice or disclaimer.

1. (Amended) An optical switch comprising:

a first optical amplifier which includes:[;]

a first erbium-doped fiber; and

a first optical pumping source connected to said first erbium-doped fiber with a first optical branch;

a second optical amplifier connected in cascade to said first optical amplifier, and which includes:[;]

a second erbium-doped fiber; and

a second optical pumping source connected to said second erbium-doped fiber with a second optical branch;

a first optical coupler connected to said first optical amplifier;

a second optical coupler inserted between said first and second optical amplifiers; and

a first control circuit for outputting first and second control signals for switching a gain of said first and second optical amplifiers.

7. (Amended) [An] The optical switch according to claim 1, further comprising:

[a first optical amplifier;

a second optical amplifier connected in cascade to said first optical amplifier; and

a first control circuit for outputting first and second control signals for switching a gain of said first and second optical amplifiers;

a third optical coupler inserted between said first and second optical amplifiers, said third optical coupler having an input-side first branch connected to an output of said first

optical amplifier and an output-side branch connected to an input of said second optical amplifier; and]

a third optical amplifier [whose output is] connected to [an input-side second branch of] said [third] second optical amplifier with said second optical coupler, and which includes:

a third erbium-doped fiber; and

a third optical pumping source connected to said third erbium-doped fiber with a third optical branch.

15. (Amended) The optical switch according to claim 1, wherein said first [optical amplifier comprises an optical fiber amplifier, and said optical fiber amplifier comprises:

an erbium-doped optical fiber; and

a] pumping source [for generating] generates a pumping light whose wavelength is in a 980 nm wavelength region to be inputted to said first erbium-doped optical fiber.

20. (Amended) An optical switch for a wavelength-division multiplexed light which is obtained by wavelength-division multiplexing a plurality of light signals, said optical switch comprising:

an optical wavelength demultiplexer for demultiplexing said wavelength-division multiplexed light into said plurality of light signals and outputting each of said plurality of light signals to each of a plurality of branches;

a plurality of single wavelength optical switches, each being connected to each of said plurality of branches; and

an optical wavelength multiplexer for multiplexing the lights outputted from said

plurality of single wavelength optical switches,

wherein each of said plurality of single wavelength optical switches comprises:

a first optical amplifier;

a second optical amplifier connected in cascade to said first optical amplifier;

a control circuit for outputting first and second control signals for switching a gain of said first and second optical amplifiers;

a first optical coupler connected to an input of said first optical amplifier; and

a second optical coupler inserted between said first and second optical amplifiers,

wherein each of said plurality of single wavelength optical switches comprises:

a first optical amplifier which includes:

a first erbium-doped fiber; and

a first optical pumping source connected to said first erbium-doped fiber with a first optical branch;

a second optical amplifier connected in cascade to said first optical amplifier, and which includes:

a second erbium-doped fiber; and

a second optical pumping source connected to said second erbium-doped fiber with a second optical branch;

a first optical coupler connected to said first optical amplifier;

a second optical coupler inserted between said first and second optical amplifiers; and

a first control circuit for outputting first and second control signals for switching a gain of said first and second optical amplifiers.

23. (Amended) The optical switch according to claim 1, further comprising:

a signal light detector for detecting whether or not a signal light is inputted to said first optical amplifier and then outputting the result of the detection as a detect signal,

said first control circuit for providing said first and second optical amplifiers with control signals for shutting down said first and second optical amplifiers, when said detect signal is inputted to said [second] first control circuit to indicate that said signal light is not inputted to said first optical amplifier.